

What is claimed is:

1 1. A circuit for providing a back EMF signal that represents a back EMF
2 voltage induced in a coil of a brushless motor, the circuit comprising:

3 an input node operable to receive a tap voltage from the coil; and
4 a network coupled to the input node and operable to generate the back
5 EMF signal by removing a predetermined offset voltage from the tap voltage.

1 2. The circuit of claim 1, wherein the network includes:

2 an output node operable to carry the back EMF signal;
3 a control node operable to receive a control voltage V_{con} ;
4 an intermediate node;
5 a first resistor $R1$ coupled between the intermediate node and the input
6 node;
7 a second resistor $R2$ coupled between the intermediate node and the
8 control node; and
9 a third resistor $R3$ coupled between the intermediate node and the output
10 node.

1 3. The circuit of claim 2, wherein $V_{con} \times (R1/(R1+R2)) = (\text{offset}$
2 voltage)/2.

1 4. The circuit of claim 1, wherein the offset voltage includes a voltage
2 drop induced by a driver of the motor.

1 5. The circuit of claim 4, wherein the voltage drop is across a diode of
2 the driver.

1 6. The circuit of claim 1, wherein the back EMF signal has a zero
2 crossing that substantially coincides with a zero crossing of the back EMF voltage.

1 7. The circuit of claim 1, wherein the offset voltage is generated by a
2 current that flows through another coil of the motor.

1 8. A driver circuit for a sensorless brushless motor having a plurality of
2 coils each inducing a respective back EMF voltage, the driver comprising:

3 a plurality of input nodes each operable to receive a tap voltage from a
4 respective coil;

5 a plurality of networks each coupled to a respective input node and
6 operable to generate a respective back EMF signal by removing a predetermined
7 offset voltage from the corresponding tap voltage; and

8 a zero-crossing detector operable to receive the back EMF signals and
9 determine there from when zero crossings of the respective back EMF voltages
10 occur.

1 9. The driver of claim 8, wherein the motor is operable in a pulse
2 width modulation (PWM) mode having a PWM-on state and a PWM-off state.

1 10. The driver of claim 8, wherein each network is further operable to
2 generate the respective back EMF signal during a PWM-off state when the
3 respective coil is floating.

1 11. A sensorless brushless motor assembly, comprising:
2 a sensorless brushless motor having a plurality of coils each generating a
3 back EMF voltage during a respective floating period; and
4 a motor driver circuit including
5 a plurality of input nodes each operable to receive a tap voltage from
6 a respective one of the coils;
7 a plurality of networks each coupled to a respective one of the input
8 nodes and operable to generate a respective back EMF signal by removing a
9 predetermined offset voltage from the corresponding tap voltage; and
10 a zero-crossing detector operable to receive the back EMF signals
11 and to determine when the zero crossings of the back EMF voltages occur.

1 12. The motor assembly of claim 11, wherein the driver circuit further
2 includes a controller operable to commutate the motor in response to the detected
3 zero crossing.

1 13. The motor assembly of claim 11, wherein the motor is operable in a
2 pulse width modulation (PWM) mode having a PWM-on state and a PWM-off
3 state.

1 14. The motor assembly of claim 13, wherein each network is further
2 operable to generate the back EMF signal during respective PWM-off states.

1 15. The motor assembly of claim 11, wherein each coil has one end
2 coupled to a center tap and the tap voltage is provided proximate to another end
3 of the coil.

1 16. A method of providing a back EMF signal that represents a back
2 EMF voltage induced in a coil of a brushless motor, comprising:

3 receiving a tap voltage from the coil; and

4 generating the back EMF signal equal to the tap voltage minus a
5 predetermined offset voltage.

1 17. A method of advancing a sensorless brushless motor having a
2 plurality of coils, comprising:

3 receiving a tap voltage from one of the coils while the coil is floating;

4 removing a predetermined offset voltage from the tap voltage to generate a
5 back EMF signal that represents a back EMF voltage induced in the floating coil;

6 detecting a zero crossing of the back EMF voltage from the back EMF
7 signal; and

8 advancing the motor a step in a commutation sequence in response to
9 detection of the zero crossing.

1 18. The method of claim 17, further comprising repeating the steps for a
2 tap voltage from another coil.

1 19. A circuit for providing a back EMF signal that represents a back EMF
2 voltage induced in a coil of a brushless motor, the circuit comprising:

3 means for receiving a tap voltage from the coil; and

4 means for generating the back EMF signal by removing a predetermined
5 offset voltage from the tap voltage.